

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Andrew Miller CAMERON, et al. Docket No.: M02B129  
Serial No. 10/517,906 Examiner: Jie YANG  
371 Date: November 7, 2005 Group Art Unit: 1793  
Title: REFINING FERROALLOYS Conf. No.: 6895

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January 20, 2010

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APPELLANTS' BRIEF UNDER 37 C.F.R. § 41.37

To the Honorable Commissioner For Patents:

This is an appeal to the Board of Patent Appeals and Interferences (the "Board") from the final rejection set forth in the Office Action mailed October 2, 2009.

In accordance with 37 C.F.R. § 41.31, Appellants electronically filed the Notice of Appeal via EFS-Web on November 25, 2009.

The present appeal is of pending claims 1-21.

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### **1. Real Party in Interest**

The owner of the present patent application is The BOC Group Limited, formerly known as The BOC Group, plc, by virtue of an assignment from the Appellants.

The real party in interest is The BOC Group Limited, formerly known as The BOC Group plc, a subsidiary of Linde Aktiengesellschaft, also known as Linde AG.

The assignment for the present patent application was recorded in the records of the Assignment Division of the United States Patent and Trademark Office (the “Office”) on July 19, 2005 at Reel/Frame 016545/0209.

**2. Related Appeals and Interferences**

In accordance with 37 C.F.R. § 41.37(c)(1)(ii), Appellants hereby inform the Board that there are no other prior pending appeals, interferences, or judicial proceedings known to Appellants, Appellants' legal representative, or Assignee which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

### **3. Status of Claims**

The present application was given a 35 U.S.C. § 371 date of November 7, 2005 after being initially submitted to the Office on December 10, 2004 with original claims 1-21. A Final Office Action for this application was mailed by the Office on September 5, 2008. A Request for Continued Examination for this application was filed with the Office on January 9, 2009. A Final Office Action for this application, subsequent to Appellants' Request for Continued Examination, was mailed by the Office on October 2, 2009.

Claims 1-21 are currently under final rejection and constitute the claims on appeal.

In accordance with 37 C.F.R. § 41.37(viii), appealed claims 1-21 appear in the Claim Appendix below.

#### **4. Status of Amendments**

A Final Office Action was mailed by the Office on October 2, 2009.

No amendments to pending claims 1-21 have been filed with the Office subsequent to the mailing date of the Final Office Action.

## 5. Summary of Claimed Subject Matter

Independent claim 1 is directed to a method of refining a ferroalloy, comprising blowing a gas selected from molecular oxygen and a gas mixture including molecular oxygen into a melt of the ferroalloy and exothermically reacting the molecular oxygen with carbon in the melt; introducing a metallurgically acceptable particulate material, capable of providing a cooling effect, from above into the melt in a first supersonic gas jet which travels to the melt shrouded by a second supersonic gas jet; and forming velocities of the first and the second supersonic gas jets for controlling migration of said particulate material between said first and second supersonic gas jets, the velocity of the second supersonic gas jet being from 10% less to 10% greater than the velocity of the first supersonic gas jet. Specification at page 3, lines 24-29, page 4, line 8, page 6, lines 27-31, and page 9, lines 18-19.

Dependent claim 8 is directed to a method according to independent claim 1, wherein the ferroalloy is ferromanganese and the metallurgically acceptable particulate material is an oxide of manganese. Specification at page 5, lines 12-14.

Dependent claim 9 is directed to a method according to independent claim 1, wherein the metallurgically acceptable particulate material is introduced into the melt in fine particulate form. Specification at page 5, lines 16-22.

Dependent claim 14 is directed to a method according to independent claim 1, wherein the second supersonic gas jet is formed of burning gases. Specification at page 7, lines 27-29.

**6. Grounds of Rejection to be Reviewed on Appeal**

A. The 35 U.S.C. § 103(a) rejection of claims 1-14 and 19-21 as unpatentable over U.S. Patent No. 5,366,537 to Schlichting in view of U.S. Patent No. 6,409,793 B1 to Edlinger.

B. The 35 U.S.C. § 103(a) rejection of claims 15-18 as unpatentable over U.S. Patent No. 5,366,537 to Schlichting in view of U.S. Patent No. 6,409,793 B1 to Edlinger, further in view of U.S. Patent No. 6,558,614 B1 to Fritz.

## 7. Argument

### A. Claims 1-14 and 19-21

Claims 1-14 and 19-21 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,366,537 to Schlichting (“Schlichting”) in view of U.S. Patent No. 6,409,793 B1 to Edlinger (“Edlinger”). Specifically, at pages 2-3 of the Final Office Action mailed October 2, 2009 (the “Final Office Action”), the Office admits that Schlichting does not disclose adding metallurgically acceptable particulate material capable of providing a cooling effect, as required by claim 1 of the present application. However, also in the Final Office Action, at page 3, the Office alleges that: (a) Edlinger teaches a method for producing steel slags containing chromium in which chromium ores or chromium-containing dusts are top-blown into the slags; and (b) it would have therefore been obvious to one of ordinary skill in the art at the time the invention was made to use the chromium-containing dusts as taught by Edlinger in the process of Schlichting in order to obtain a high-grade ferrochromium alloy. Appellants respectfully traverse.

#### The Office Has Not Established a Prima Facie Case of Obviousness

Preliminarily, Appellants note that at page 5 of the Final Office Action, the Office alleges that Appellants’ arguments in previous Responses “are against the references individually”, and that “one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references.” Since it is necessary to argue the appropriateness of the combination of references with regard to arguing that the Office has not established a prima facie case of obviousness, Appellants respectfully submit that it is necessary to discuss the references individually in order to show their differences as well as their incompatibility.

#### Schlichting discloses

a process and apparatus for introducing oxygen and a carbonaceous fuel into a smelting and/or metal refining furnace. In particular, the invention concerns the introduction of oxygen and carbonaceous fuel into the furnace through a lance in such a manner that the volatile matter content of the fuel is combusted in a fashion permitting optimum utilization of the heat of combustion in the smelting or refining operation.

Column 1, lines 9-19. From this disclosure, a person of ordinary skill in the art would understand that the purpose of Schlichting is to maintain and/or increase the heat of combustion occurring within the smelting or refining operation being performed by adding a carbonaceous fuel and oxygen. This proposition is supported by Schlichting: "The oxidation of the additional carbon and the subsequent secondary oxidation of the resulting carbon monoxide result in the release of sufficient additional energy to maintain the temperature of the melt and to melt the cold scrap additions." Column 1, lines 51-55.

Regarding the specific carbonaceous materials used, Schlichting states that

"[c]arbonaceous material used as fuel generally contains combustible volatile matter. For example, coal used in the reduction of iron ore may contain volatile matter such as hydrogen, which is utilized as a fuel source to generate the necessary heat for the reaction. Examples of other suitable sources of carbonaceous material are coke, graphite, char, and hydrocarbon gases or liquids, (e.g., petroleum products)."

Column 2, lines 39-46.

Edlinger discloses "a method for processing steel slags and optionally iron carriers . . . derived from steel production, mill scale or secondary metallurgical residues." Column 1, lines 12-15. The purpose of Edlinger is to improve previous processes of producing steel in order to produce environmentally friendly slags. Abstract, column 1, lines 34-35, and column 2, lines 12 and 58-60.

To that end, Edlinger states that "the process according to the invention essentially consists in that the molten steel slags and iron carriers, respectively, are supplemented with chromium ores or chromium-containing and/or nickel-containing dusts in order to adjust a slag basicity of 1.2 to 1.6". Column 1, lines 43-47.

Appellants respectfully submit that Schlichting and Edlinger are not properly combinable because Schlichting teaches away from any combination with Edlinger as discussed below, and because modifying either reference according to the other would render each reference unsatisfactory for its intended purpose.

MPEP § 2146(X)(D)(2) states that “[i]t is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983)”. MPEP at 2100-168. Replacing the carbonaceous material of Schlichting with the non-combustible chromium ores or chromium-containing dusts of Edlinger would eliminate the desired effect that the carbonaceous material has on the smelting and/or refining operation of Schlichting, namely the additional heat of combustion provided by the carbonaceous material.

Similarly, adding the non-combustible chromium ore or chromium-containing dusts of Edlinger to the smelting and/or refining operations of Schlichting would reduce the heat of combustion provided by the carbonaceous material of Schlichting, because the non-combustible materials of Edlinger would inhibit the oxidation reaction occurring between the carbonaceous material and the oxygen provided by Schlichting. For these reasons, Schlichting teaches away from any combination with Edlinger, and Appellants respectfully submit that the Office has failed to state a *prima facie* case of obviousness.

MPEP § 2143.01(V) states that, “[i]f proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gorden*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)”. MPEP at 2100-140. Modifying Schlichting according to Edlinger would render Schlichting unsatisfactory for its intended purpose, namely adding additional heat to the smelting and/or refining operation of Schlichting by adding combustible carbonaceous material to the melt. As discussed above, the additional heat produced by adding the carbonaceous material of Schlichting would be significantly reduced or altogether eliminated if the noncombustible materials of Edlinger were combined with or replaced the carbonaceous material of Schlichting.

Further, combining or replacing the chromium ore or chromium-dust containing dusts of Edlinger with the carbonaceous fuel of Schlichting would defeat the purpose of Edlinger, namely to purify the slag produced, because the carbonaceous fuel would increase the undesirable byproducts present in the slag, as discussed throughout Edlinger. Appellants respectfully submit that, for these additional reasons, the Office has failed to state a *prima facie* case of obviousness.

### The Office's Burden of Proving Inherency Has Not Been Met

At page 3 of the Final Office Action, the Office alleges that combining Schlichting and Edlinger as previously discussed would inherently provide the cooling effect required by claim 1 of the present application. MPEP § 2112(IV) states that

[t]he fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) . . . “To establish inherency, the extrinsic evidence ‘must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.’ ” *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted)

MPEP at 2100-47 (emphasis in original). Further,

“In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.” *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original)

MPEP 2112(IV) at 2100-48. Thus, the relevant case law has established that in order to establish a *prima facie* case of inherency, the Office must establish that the inherency must necessarily be present and it must be recognized as necessarily present by a person of ordinary skill in the art.

However, the Office merely states that “the introduction of the same metallurgical [sic] acceptable particular [sic] material as recited in the instant invention, for example, chromium ores or chromium-containing dusts as demonstrated by [Edlinger] would inherently lead to the cooling effect to the molten metal process of [Schlichting] in view of [Edlinger].” The Office does not indicate any specific facts which would indicate that this is necessarily true according to the combination of references, and further does not indicate any specific facts which establish that a person of ordinary skill in the art would recognize that the alleged inherency is necessarily present. For these reasons, discussed in detail below, Appellants respectfully submit that the Office has failed to meet its burden of establishing inherency.

The combination of references is alleged by the Office, at pages 2-3 of the Final Office Action, to teach or suggest adding chromium ore or chromium-containing dusts (Edlinger) to a molten metal process (Schlichting). If each references is taken as a whole (MPEP § 2141.03(VI)), the molten metal into which the injection is being made must contain at least 3% by weight carbon throughout the process (Edlinger, column 1, line 66), and the final product may contain up to 9% by weight carbon (Edlinger, column 2, line 6).

The present application discloses that the metal melt may contain up to 6% by weight carbon at the beginning of the process, but by the end of the process should contain below 2% by weight (page 9, lines 10-13). Further, the cooling effect provided by the presently claimed subject matter relies at least in part upon the metallurgically acceptable particulate material reacting with carbon in the metal melt. Page 4, lines 12-20. Since the amount of carbon in the method of the present application decreases throughout the process, and the amount of carbon in the process of the Schlichting/Edlinger combination is maintained or increases, it is not clear that adding chromium ore or chromium-containing dusts provides a cooling effect in the process of the Schlichting/Edlinger combination.

Therefore, the Office cannot prove that the cooling effect is necessarily provided by the combination of Schlichting and Edlinger, nor can it prove that a person of ordinary skill in the art would recognize the necessary presence of a cooling effect. Appellants therefore respectfully submit that the Office has failed to establish its burden of proving inherency, and has therefore failed to state a *prima facie* case of obviousness.

For the above reasons, Appellants respectfully request that the 35 U.S.C. § 103(a) rejection of claim 1 be reversed.

#### **Dependent Claim 8**

At page 3 of the Final Office Action, the Office incorporates its rejection of claim 8 from the previous Office Action, mailed March 16, 2009, by reference. At page 7 of the Office Action mailed March 16, 2009, with regard to claim 8, the Office alleges that Edlinger “teaches that the chromium ore includes 5.3wt% MgO, which reads on the oxide of manganese acting as metallurgically acceptable material as recited” in claim 8. Applicants respectfully submit that

the Office's argument is technically flawed. The chemical symbol for manganese is Mn, not Mg, which represents magnesium. Edlinger nowhere discloses the use of manganese, and thus cannot teach or suggest a ferroalloy or metallurgically acceptable particulate material containing manganese as recited in present claim 8. Appellants respectfully submit that, for these reasons, the Office has failed to state a *prima facie* case of obviousness with regard to claim 8, and request that the 35 U.S.C. § 103(a) rejection of claim 8 be reversed.

#### **Dependent Claims 9 and 10**

At page 2 of the Final Office Action, the Office incorporates its rejection of claim 9 from the previous Office Action, mailed March 16, 2009, by reference. At page 4 of the Office Action mailed March 16, 2009, with regard to claim 9, the Office alleges that Schlichting "teaches charging metallurgical [sic] acceptable material, for example carbonaceous material including of [sic] coal, coke, graphite, char, and hydrocarbon gases or liquids (claim 8 of [Schlichting]); or charging in the form of solid plugging (Col.6, lines 10-22 of [Schlichting]), which reads on the limitation of introducing metallurgical [sic] acceptable particular [sic] material in fine particular [sic] form as recited in the instant claim."

Appellants respectfully note that column 6, lines 10-22 of Schlichting does not appear to teach or suggest charging the carbonaceous material in the form of solid plugging. Further, it is unclear as to how the disclosures of Schlichting discussed in the rejection of claim 9 read on the subject matter of claim 9, regardless of the accuracy of the citations provided by the Office. Claim 9 recites that "the metallurgically acceptable particulate material is introduced into the melt in fine particulate form." Disclosures regarding the type of carbonaceous material provided by Schlichting, or that the material is charged in the form of solid plugging, do not teach or suggest introducing the metallurgically acceptable particulate material into the melt in fine particulate form. Appellants respectfully submit that, for these reasons, the Office has failed to state a *prima facie* case of obviousness with regard to claim 9, and request that the 35 U.S.C. § 103(a) rejection of claims 9 and 10 (that depends from claim 9) be reversed.

#### **Dependent Claim 14**

At page 2 of the Final Office Action, the Office incorporates its rejection of claim 14 from the previous Office Action, mailed March 16, 2009, by reference. At pages 4-5 of the Office Action mailed March 16, 2009, with regard to claims 11-14, the Office alleges that Schlichting “teaches inert gas flow and oxygen gas flow (Col.2, line 39 to Col.4, line 60 of [Schlichting]), which reads on the oxidizing gas (claims 11, 12, 14) and the non-oxidizing gas (claims 11 and 13).” Present claim 14 recites “[a] method according to claim 1, wherein the second supersonic gas jet is formed of burning gases.” Claim 14 does not read on inert gas flow or oxygen gas flow, as alleged by the Office. Appellants therefore respectfully submit that the Office has failed to allege that either Schlichting or Edlinger, alone or in combination, teach or suggest the features of claim 14. Appellants respectfully submit that, for these reasons, the Office has failed to state a *prima facie* case of obviousness with regard to claim 14, and request that the 35 U.S.C. § 103(a) rejection of claim 14 be reversed.

#### **Remaining Dependent Claims**

Appellants respectfully submit that, since claim 1 is not rendered obvious by the combination of Schlichting and Edlinger for the above reasons, claims 2-14 and 19-21, which ultimately depend from claim 1, are also non-obvious. *See In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). (“If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious.” MPEP § 2143.03 at page 2100-142.) Appellants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 2-14 and 19-21 be reversed.

#### **B. Claims 15-18**

Claims 15-18 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,366,537 to Schlichting (“Schlichting”) in view of U.S. Patent No. 6,409,793 B1 to Edlinger (“Edlinger”), further in view of U.S. Patent No. 6,558,614 B1 to Fritz (“Fritz”).

The deficiencies of the combination of Schlichting and Edlinger have been discussed in detail above. Fritz, which is utilized by the Office for allegedly disclosing “a method for producing a metal melt involving the charging of solid metal oxides and a lance for use in the described method”, does nothing to correct the deficiencies of the alleged Schlichting/Edlinger combination.

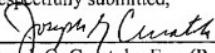
Further, Appellants submit that, since claim 1 is not rendered obvious by the combination of Schlichting and Edlinger for the above reasons, claims 15-18, which ultimately depend from claim 1, are also non-obvious. *See In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). (“If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious.” MPEP § 2143.03 at page 2100-142.) Appellants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 15-18 be reversed.

### **Conclusion**

Appellants have addressed the instant rejections presented in the Final Office Action (including those rejections presented in the Office Action mailed March 16, 2009 which were incorporated by reference into the Final Office Action) with respect to independent claim 1 and dependent claim 9 in particular, and have distinguished the applied references as discussed above. It is therefore deemed unnecessary to address the Office’s specific allegations regarding the remaining dependent claims. Appellants therefore traverse these allegations, and do not concur with the same either explicitly or implicitly by not refuting each individually.

Appellants submit that the remarks presented hereinabove overcome all the existing 35 U.S.C. § 103(a) rejections of all pending claims. Appellants respectfully request the Board to reverse the final rejections of these claims, and to require the Office to issue a formal notice of allowability of claims 1-21 over the art of record.

Respectfully submitted,

  
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## 8. Claims Appendix

In accordance with 37 C.F.R. § 41.37 (c)(1)(ix), the claims on appeal are as follows:

1. (Previously Amended) A method of refining a ferroalloy, comprising blowing a gas selected from molecular oxygen and a gas mixture including molecular oxygen into a melt of the ferroalloy and exothermically reacting the molecular oxygen with carbon in the melt; introducing a metallurgically acceptable particulate material, capable of providing a cooling effect, from above into the melt in a first supersonic gas jet which travels to the melt shrouded by a second supersonic gas jet; and forming velocities of the first and the second supersonic gas jets for controlling migration of said particulate material between said first and second supersonic gas jets, the velocity of the second supersonic gas jet being from 10% less to 10% greater than the velocity of the first supersonic gas jet.
2. (Previously Amended) A method according to claim 1, wherein the metallurgically acceptable particulate material is selected from the group consisting of metals that are to be included in the refined alloy, alloys of said metals, oxides of said metals, and mixtures thereof.
3. (Previously Amended) A method according to claim 1, wherein the ferroalloy contains at least 30% by weight of iron.
4. (Previously Amended) A method according to claim 1, wherein the ferroalloy is ferrochrome and the metallurgically acceptable particulate material comprises an oxide of chromium.
5. (Original) A method according to claim 4, wherein the oxide of chromium is chromite.
6. (Previously Amended) A method according to claim 1, wherein the metallurgically acceptable particulate material comprises ferrochrome.

7. (Previously Amended) A method according to claim 1, wherein the ferroalloy is a stainless steel and the metallurgically acceptable particulate material is an oxide of chromium.
8. (Previously Amended) A method according to claim 1, wherein the ferroalloy is ferromanganese and the metallurgically acceptable particulate material is an oxide of manganese.
9. (Previously Amended) A method according to claim 1, wherein the metallurgically acceptable particulate material is introduced into the melt in fine particulate form.
10. (Previously Amended) A method according to claim 9, wherein the metallurgically acceptable particulate material has a mean particle size of 1 mm or less.
11. (Previously Amended) A method according to claim 1, wherein a gas that forms the first supersonic gas jet is selected from the group consisting of an oxidising gas, a non-oxidising gas, or a mixture of an oxidising gas and a non-oxidising gas.
12. (Original) A method according to claim 11, wherein the oxidising gas is oxygen.
13. (Previously Amended) A method according to claim 11, wherein the non-oxidising gas is selected from the group consisting of argon, steam and combinations thereof.
14. (Previously Amended) A method according to claim 1, wherein the second supersonic gas jet is formed of burning gases.
15. (Previously Amended) A method according to claim 1, wherein the first supersonic gas jet is ejected from a first Laval nozzle at a velocity in the range of Mach 1.5 to Mach 4 and the second supersonic gas jet is ejected from a second Laval nozzle at a velocity in the range of Mach 1.5 to Mach 4.

16. (Previously Amended) A method according to claim 15, wherein the first and second Laval nozzles form part of a metallurgical lance comprising an axial first gas passage terminating at its outlet and in the first Laval nozzle, a shrouding gas passage about a main gas passage terminating at its outlet in the second Laval nozzle, and a particulate material transport passage having an axial outlet which communicates with the first Laval nozzle.
17. (Previously Amended) A method according to claim 16, wherein the axial outlet terminates in a divergent part of the first Laval nozzle.
18. (Previously Amended) A method according to claim 16, wherein the shrouding gas passage comprises a combustion chamber.
19. (Previously Amended) A method according to claim 1, wherein the metallurgically acceptable particulate material is introduced into the melt continuously during a first part of a refining operation.
20. (Previously Amended) A method according to claim 19, wherein the first supersonic gas jet comprises oxygen and introduction of the first supersonic gas jet into the melt continues after introduction of the metallurgically acceptable particulate material into the melt has ceased.
21. (Previously Amended) A method according to claim 20, wherein introduction of the first supersonic gas jet into the melt ceases before the end of the refining operation.

**9. Evidence Appendix**

None.

**10. Related Proceedings Appendix**

None.